IEC 61724-1:2021

Selection of pyranometers for compliance with the new standard

The IEC 61724-1 standard for PV system performance monitoring has been revised. The latest version, released July 2021, defines 2 "accuracy classes." In conformity declarations, providers must state the accuracy class of the measurement. The class is determined not only by the hardware used, but also by quality checks and measurement procedures. The standard contains detailed specifications at the monitoring system component level. This memo discusses the implications of the revised standard for the selection of pyranometers. It outlines requirements for solar radiation measurements and identifies which pyranometers comply. A separate memo provides a general explanation of IEC 61724-1:2021.

Introduction

The first edition of IEC 61724-1: Photovoltaic system performance monitoring – Guidelines for measurement, data exchange and analysis was published in 2008. It has since been updated twice. The latest 2021 version of the standard is fundamentally different from the 2008 edition and has slightly changed relative to the 2017 version.

The new standard includes:

- 2 accuracy classes (A and B) for monitoring systems, to be used in conformity declarations (2017 Class C is now Class B)
- accuracy requirements for monitoring equipment per class
- required quality checks (i.e., calibration and maintenance) per class
- recommended minimum number of instruments based on the PV system scale
- new in 2021: requirements for reflected radiation and albedo measurement
- requirements for tilt sensors included

Consequences

The 2021 version of the standard recognizes solar irradiance measurement as one of the weakest links in the measurement chain. For Class A systems, it specifies the class of pyranometer that may be used, including requirements for dew and frost mitigation, azimuth, and tilt angle accuracy. It also defines cleaning and calibration intervals for pyranometers. Furthermore, the standard defines requirements for measurement of module and air temperature, wind speed and direction, soiling ratio, and AC/DC current and voltage.

Figure 1 Frost and dew deposition: clear difference between a non-heated pyranometer (left) and SR300 with heating (right).

Why heating?

IEC 61724-1:2021 requires pyranometer dew and frost mitigation for Class A monitoring systems. Why? Pyranometer domes are made of glass. When facing the sky on a clear night, glass temperature tends to go below dewpoint, causing condensation. Heating and ventilation of solar radiation sensors keep the glass temperature above dewpoint and free from dew and frost deposition. This significantly increases the reliability of the measured data. There is an exception for locations where dew and frost is expected for less than 2 % of annual GHI hours.

The following tables provide an overview of the main elements of the IEC 61724-1 monitoring classification system, its requirements for solar radiation measurement, and which pyranometers comply with each accuracy class.

Table 1 The main elements of the IEC 61724-1:2021 PV monitoring system classification system.

	Class A	**Class B**	**Class C**
accuracy	high	medium	low
target application	utility-scale PV systems and large commercial	rooftop or small to medium-sized commercial new in 2021: old (2017) Class C is now Class B	new in 2021: no longer used

Table 2 Requirements for solar radiation measurement in the IEC 61724-1 monitoring classification system (continued on next page).

	Class A	**Class B**	**Class C**
irradiance measurement	for GHI and for POA: pyranometer spectrally flat Class A (secondary standard) or for POA only: matched high-accuracy PV reference cell (same cell type and anti-reflection coating as the PV system)	POA measurement and panel temperature measurement are required. GHI and other parameters may be derived by other means than on-site measurement, such as satellite observation.	N/A

	for reflected irradiance: Class C pyranometers or PV reference cells may be employed	
dew and frost mitigation	required, except for locations where dew and frost is expected for less than 2 % of annual GHI hours Whether an installation site requires mitigation is decided by analysis of typical meteorological year data for the site. Dew or frost is considered to be expected when ambient temperature is within 1.5 °C of dew point.	not required
cleaning	1 x / week (unless it can be proven unnecessary)	not required
alignment	tilt ± 1 ° azimuth ± 2 °	not required
quality checks	calibration prior to use calibration 1 x / 2 yr	calibration prior to use calibration schedule as recommended by manufacturer
number of systems per PV power plant	minimum recommended number depends on system size	minimum recommended number depends on system size

Table 3 Compliance of Hukx pyranometers with Class A, B, and C monitoring system requirements.

Class A	Class B	Class C
SR300 and SR30 meets Class A PV monitoring system requirements for solar irradiance for all locations and climatic conditions and for tracker tilt angle measurements	SR200, SR20-D2, SR15, SR05 meets Class B PV monitoring system requirements for solar irradiance for all locations and climatic conditions	N/A
SR20 all versions + VU01 ventilation unit SR20-T1 and T2* meets Class A PV monitoring system requirements for solar irradiance for all locations and climatic conditions		
SR200, SR20-D1 meets Class A PV monitoring system requirements for locations where dew and frost is expected for less than 2 % of annual GHI hours.		

* The heater is not necessarily switched on; for operation within ISO 9060 Class A specifications, activate the heater when the sun is below the horizon.

SR300: compliant with IEC, Class A

IEC 61724-1: *Photovoltaic System Performance Monitoring—Guidelines for Measurement, Data Exchange and Analysis* requires dew and frost mitigation for Class A monitoring.

The SR30 pyranometer, released by Hukx in January 2017, was the first pyranometer compliant in its standard configuration with the requirements for Class A PV monitoring systems of the new IEC 61724-1:2017 standard.
Like SR30, th latest model SR300 offers heating without the need for additional accessories, such as a traditional ventilation system.

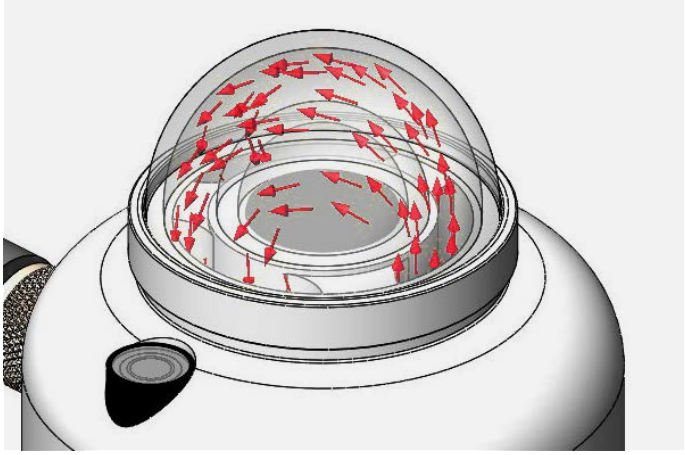

Figure 2 Heating: How it works—Recirculating Ventilation and Heating (RVH™) technology ventilates the area between the inner and outer dome, forming a closed circuit with the body. RVH is much more power-efficient than traditional ventilation systems, where most of the heat is carried away with the ventilated air.

Heated for high data availability

High data availability is attained by heating the outer dome by ventilating air between the inner and outer dome. This space forms a closed circuit together with the instrument body; ventilated air is not in contact with ambient air. Recirculating Ventilation and Heating (RVH™) technology, developed by Hukx, mitigates dew and frost and is as effective as traditional ventilation systems, without the maintenance hassle and large footprint. The instrument has 2 heating modes: normal (< 3 W) and medium (< 0.65 W).

– **low power consumption:** SR300 requires less than 3 W, compared to 10 W for traditional ventilation systems.
– **low maintenance:** SR0 does not require filter cleaning or replacement.

The dome of the SR300 pyranometer is heated by ventilating the area between the inner and outer dome. RVH TM is much more efficient than traditional ventilation, where most of the heat is carried away with the ventilation air.

At under 3 W, recirculating ventilation is as effective in suppressing dew and frost deposition as traditional ventilation is at 10 W. RVH TM technology keeps domes and sensor in perfect thermal equilibrium, which leads to a reduction of zero offsets.

Figure 3 Two SR300 Class A pyranometers with digital output for GHI (Global Horizontal Irradiance) and POA (Plane of Array) measurement applications.

About Hukx

Hukx is the leading innovator in solar radiation and heat flux sensor technology. We are proud to set the standard in high-accuracy measurement, and to be working at the heart of the energy transition.

Customers worldwide rely on our bestselling pyranometers and heat flux sensors. From sensor design and selection to supply and recalibration, we support you across the entire lifecycle.

Hukx is headquartered in the Netherlands, with locally owned representative sales offices in the USA, Brazil, India, China, Southeast Asia, and Japan.

Let us help you select the best sensor for your application.
Get in touch with our experts today via: info@hukx.com

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